New Castle & Frenchtown Railroad, 1830 HAER DE-18
Belltown Run
(Near Glasgow) NEW CASTLE
Delaware

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
National Park Service
Department of the Interior
Washington, D. C. 20240

HAER,DEL,2-NEWCA,44-

HISTORIC AMERICAN ENGINEERING RECORD

New Castle and Frenchtown Railroad
HAER DE-18

Location: Ran between New Castle, Delaware and Frenchtown, Maryland. Extant structures include:

C UTM: 18.438040.438420 Belltown Run Culvert
Quad: St. Georges

A UTM: 18.429620.4380520 Perch Creek Culvert
Quad: Elkton No. 1.

B UTM: 18.430680.4380720 Perch Creek Culvert
Quad: Elkton No. 2.

[D Perch Creek Culvert #3]

Date of Construction: 1830-1832

Present Use: Eastern third of right-of-way is still a track-bed. Remainder is abandoned.

Significance: This was the first railroad chartered by Delaware, and one of the earliest operating lines in the U. S.

Historian: Larry D. Lankton, 1976.

The New Castle and Frenchtown Railroad and Turnpike Company was formed in the spring of 1830. Mid-Atlantic capitalists initially subscribed $235,000 worth of stock in the organization, which quickly began to construct a 16 1/2-mile-long railroad between New Castle, Delaware and Frenchtown, Maryland. Cutting across the top of the Delmarva Peninsula, this railroad was intended as an important transportation link between Philadelphia and Baltimore. It would supplant an old turnpike between New Castle and Frenchtown and compete for traffic with the new Chesapeake and Delaware Canal. Philadelphians bound for Baltimore would begin their journey on a steamboat heading down the Delaware River. At New Castle they would disembark and board the railroad. After riding across the neck of the peninsula, the travelers would board a second steamboat at Frenchtown Wharf. This vessel would carry them down the Elk River into Chesapeake Bay and on to Baltimore.

The new Castle and Frenchtown was the first railroad chartered by the state of Delaware. It opened for service on 28 February 1832, making it one of the earliest operating lines in the United States. Unfortunately for the company, it was also one of the first running American railroads to fail. In 1843 it succumbed to the Philadelphia, Wilmington and Baltimore Railroad--a line with direct connections between Philadelphia and Baltimore that did not require its passengers (and freight) to begin and end the journey on steamboats. Yet despite its short life-span, the New Castle and Frenchtown Railroad presents an interesting case study of first-generation railroad builders, of men who strove to introduce a new technology into the American economy.

The Entrepreneurs

The New Castle and Frenchtown Railroad and Turnpike Company was formed on 31 March 1830, when stockholders voted to merge the New Castle Turnpike and the New Castle and Frenchtown Turnpike companies. [1] Following the merger, the company's affairs were put under the control of three officers and a Board of Directors. The capitalists who first filled these positions were largely drawn from New Castle, Frenchtown, and Baltimore. John Janvier served as President; James Couper as Treasurer; and C. D. Blaney as Secretary. There were 13 directors. [2]

As stock subscriptions increased in 1830, the company grew to have a number of Philadelphia investors. Because they arrived late on the scene, the Philadelphians found themselves unrepresented by the original company officers and directors. In May 1831, the Philadelphians fought for representation at a stockholders' meeting, and as a result, four original directors were dropped and four Philadelphians were added. [3] Shortly thereafter, John Janvier

resigned as President and was replaced by James Booth. Following this shake-up, William D. Lewis and Samuel Nevins, two of the directors from Philadelphia, "exerted the strongest influence in directing the affairs of the company." [4]

The officers and directors of course managed the financial affairs of the railroad. They oversaw stock transactions, floated loans, lobbied legislators, advertised for materials and work, entered contracts and met payrolls. At the same time, they were deeply involved in the actual engineering and outfitting of the railroad, in its design and construction. This involvement was too intense to be explained only in terms of self-interest; they were doing more than just protecting their investments. Building a railroad was an alluring adventure to these men. They were not just watchful of its progress; they were drawn into the work. Also, railroad construction in 1830 was novel and filled with uncertainties. The officers and directors thought that there was safety in numbers, that the more heads involved in the effort, the greater the chance for achieving a "glorious triumph." [5]

The officers' involvement in the technology of the railroad was written into the company by-laws on 15 April 1830. The President was:

> To procure from all accessible sources information respecting Rail Roads, Carriages and Locomotive Engines to be used thereon; the best and most permanent modes of construction, facilities and improvements as to manner. . .and safety of conveyance and passage--the costs and charges--the materials suitable to the construction of the artificial road will form a most important part of this inquiry--and also their size and dimensions--to correspond with those persons abroad from whom there might be expected to derive useful knowledge of the subject. . . .[6]

The officers and directors indeed did their homework. They studied accounts of English railroads and read about and visited the earliest American lines. By cultivating contacts with other American railroad entrepreneurs and engineers, they gathered information which they applied to their own situation. They constantly compared their railroad with others, and while the New Castle and Frenchtown was under construction, the directors, especially Lewis, Nevins, and Thomas Stockton, made numerous personal inspections of the line. They walked it, making minute examinations of various types of work. When the directors met regularly to discuss the railroad's progress, they often criticized the work and recommended changes. [7]

The Engineers

The railroad's Chief Engineer was John Randel, Jr., hired on 1 April 1830 at an annual salary of $1,500. [8] Randel, from Albany, New York, began his professional career as a surveyor and evolved into an engineer. While working out of the Office of the Surveyor General of the State of New York, he had served as the principal surveyor for a commission laying out a street plan for Manhattan Island. He later continued his work on Manhattan's streets while employed by New York City. In 1823, DeWitt Clinton characterized Randel as "an eminent mathematician, and a most skillful practical surveyor." [9]

Delawarians came to know Randel through his work on the Chesapeake and Delaware Canal, whose route he had surveyed in 1824. After routing the canal, Randel contracted for work on it; he was encharged with constructing its eastern section. While working as a contractor, Randel gained his greatest notoriety when he became embroiled in a long dispute with Judge Benjamin Wright, the canal's Chief Engineer and one of the most sought after engineers in the United States. This dispute actually dated back to 1822, when Randel had authored a pamphlet critical of Wright's work on the Erie Canal. Randel charged that Wright had erred in routing the Erie, that he had unnecessarily extended it 19 1/2 miles at a cost of $630,000. Wright apparently took considerable umbrage at this critique, and according to one source, he set out to "cripple, harass, and ruin" its author. [10] On the Chesapeake and Delaware Canal, Wright deviously set prices for various kinds of work so low that Randel could not profitably execute his contract. Then Wright had the canal company declare that contract violated and abandoned. The result of this clash was a prolonged lawsuit, which finally ended with Randel receiving a judgment of over $200,000 in his favor.

Randel, then, came to the New Castle and Frenchtown Railroad with some valuable practical experience. He had already routed one transportation system across the Delmarva Peninsula, the C & D Canal. Now he would route another. He also came to the railroad with a reputation for finding controversy, and this reputation would be sustained. Randel's tenure on the New Castle and Frenchtown Railroad was not without incident. The Chief Engineer clashed with the railroad's officers, with contractors, and with his assistant engineers.

The first assistants to join Randel included Edward Griswold, William Cushman and Charles Mortimer. The Chief Engineer did not bring these men with him to the project; they had not worked for him before. Upon hearing of the railroad, they had written the directors, and had been hired by the directors, although presumably with Randel's consent. Others who joined the railroad's engineering

department included Benjamin P. Fowler, John Ewen, Rosewell Graves, William Ritchie and Thomas Cooch. William R. Crispy an architect, was briefly attached to the department as Superintendent of Construction. [11]

Extant records of disbursements made to the engineering department suggest that while the railroad was being planned and constructed, its engineering department numbered from 6 to 10 men at any one time. Not all of these men were skilled engineers, a fact reflected by their salaries. While Randel earned $1,500 per year, his principal assistant in 1831 and 1832, John Ewen, earned $70 per month. Most of the other assistants received only $2.00 for each day worked, and a few received as little as $1.75 per day. Several of the assistants worked under a year's contract; others worked on a part-time or an on-call basis. Obviously, a number of the "engineers" were not really engineers at all. They were young men just breaking into the profession, men learning their trade while working on the job.

In assessing the performance of the New Castle and Frenchtown's engineering department, one conclusion is inescapable: they were at best a mediocre lot. None of the individuals, including Randel, ever rose to prominence in the engineering profession, despite the fact that they worked in an era characterized by great upward mobility for skilled engineers. [12] As innovators, they suffered; they were primarily borrowers of technology. As managers, they lacked authority and failed to keep a tight rein on the railroad's affairs. As members of a department, they lacked discipline, mutual respect and cohesion. In short, they lacked professionalism.

A chief engineer working for canal- or railroad-building entrepreneurs in 1830 did not have autonomy in deciding technical questions; designs and plans were always subject to final review, criticism and change by men whose dollars were being put to work. Consequently, one can measure the professional status of an early engineer by examining how he fared in this review process. Where did the balance of power reside between the engineer and the entrepreneurs? Was the engineer in an equal, a dominant, or a subordinate position? Did the entrepreneurs defer to him, or did he defer to them? It would seem to hold true that those engineers who had demonstrated the most expertise also earned for themselves the greatest amount of deference. In the case of John Randel, he was the Chief Engineer of the New Castle and Frenchtown, and at the same time engineer of the Ithaca and Owego Railroad in New York. [13] Yet his expertise as a railroad builder was not proven, and his authority and his technical decisions were therefore open to more than the usual amount of scrutiny and challenge. Indeed, in some important areas, such as in the selection of locomotives and the procurement of quality building materials, Randel was seemingly little involved in the decision-making process, or not involved at all. The Chief Engineer did not stand in a very strong position vis-a-vis the railroad directors and officers.

This fact was made clear in mid-1831, when Randel clashed with John Janvier, the railroad's President. The two men had been issuing conflicting orders to contractors working on the line, and their disagreements came to a head over the question of how to construct the line across low, swampy areas. This last debate degenerated into a show-down, into a "him-or-me" situation. The one or the other had to go. Randel, on the face of it, won the show-down handily, because it was Janvier who left the railroad. In addition, the directors passed a resolution that attempted to bolster the Chief Engineer's faltering authority:

> Resolved that the contractors and superintendents be immediately notified by the Secretary that in [the] future all orders respecting the excavation, formation laying of all the rails, and dressing of the road. . .are to emanate from the Engineer in Chief only, and that no orders, varying from his and emanating from any other person are to be obeyed. [14]

Randel had won a victory, but it was far from complete. The directors did not at all foreswear their own intense involvement in engineering the railroad; they merely structured that involvement. These men were in a hurry to open a railroad, and for the sake of efficiency they allowed Randel to deal with contractors as the company's single authoritarian spokesman. But at the same time, the directors had no intentions of totally stilling their own voices:

> . . .it is the duty of each and every director, in case he believes, in the exercise of his own judgement, that the good of the work requires a variation in any of the plans of the Engineer in Chief, or in a countermand of his orders, to report the matter to the Board of Directors for their consideration and determination upon the subject. [15]

After Janvier left the scene, Randel enjoyed an amicable relationship with the railroad's directors. George Read praised him for his "capacity--industry--economy," [16] and in 1832, the directors as a group expressed their "entire satisfaction. . .with the manner in which he has located and planned the construction of the Rail Road. . ., and [with] the ability and zeal displayed by him in the prosecution of the said work." [17] The directors <u>liked</u> Randel; they <u>wanted</u> to praise him. Yet at the same time, they recognized his limitations, even if they did not condemn them. The directors turned to themselves for technical answers as much as they turned to their Chief Engineer. For real expertise, particularly when mechanical problems were encountered, they often turned to outsiders, to men such as William Strickland, Moncure Robinson, M. W. Baldwin and Jonathan Knight. Samuel Nevins, the influential director, noted one of Randel's many deficiencies--a lack of knowledge regarding the construction of the railroad cars used to transport materials up and down the completed portions of the line. Jonathan

Bonney of Wilmington had constructed the earliest cars under Randel's direction, and Bonney had come under fire when the cars failed because of wheel and axle problems:

> Bonney is here and will have one or two cars ready on Saturday. He says if things had been left to him he would have had them right and I confess I am inclined to that opinion--I want no more experiments--I imagine that Randel. . .know[s] as little about R[ail]Road Cars as I do--which is just nothing at all. [18]

Nevins pointed out another of the Chief Engineer's deficiencies his failure to manage contractors, to keep them in line. Even if Randel's word to contractors was supposed to be final, his word carried little clout. Some contractors apparently deemed the Chief Engineer a nuisance:

> Although I like R----l, I hope he will not come back at present. . . .Riddle and his men have worked like Horses--the absence of poor R----l seems to be a signal to them all to work as they ought to do. [19]

Randel's word carried questionable clout even within his own department. By the end of 1830, six months after the engineering department had been formed, the directors authorized Randel:

> . . .to dismiss from the service of the Company any assistant or other person employed in his department, who may refuse or neglect to conform to his orders or instructions. [20]

This authorization was apparently not enough to dissuade Randel's assistants, who were "blockheads," according to director George Read, from engaging in "insubordinate behavior." Three assistants-Griswold, Cushman, and Mortimer--learned their lesson the hard way in mid-1831, when they were finally fired or pressured into resigning. [21] Still, the lesson was a forgettable one. Near the end of June 1831, the directors appointed William Crisp Superintendent of Construction. Crisp, under the direction of the Chief Engineer,was to inspect the manner in which track was being laid. Only a month and a half after his appointment, the directors found it necessary to resolve that:

> . . .William R. Crisp be and is hereby required to perform such duties on the New Castle and Frenchtown Rail Road as shall be directed by the Engineer in Chief, to whose instructions in [the] future, the said William R. Crisp is to conform in all things and to whom he is hereafter to make his reports and communications. [22]

To summarize, John Randel, Jr. fared rather poorly as a Chief Engineer. Because he worked on two railroads at once, he was often absent from the line during crucial periods. He exerted no firm control over his assistants or contractors. In an age when a civil engineer often doubled as a mechanical engineer, he had no real knowledge of railroad rolling stock or of mechanical devices such as switches and pivots. He deferred a great deal to the directors. They, and not the Chief Engineer, sought out the solutions to many of the railroad's technical problems. Randel did a good job of routing the railroad, but that had been expected. He was, after all, a surveyor of some reputation. His subsequent, mediocre performance only served to demonstrate that surveying and engineering were two related but different skills.

One could perhaps defend Randel's performance by arguing that in 1830 to 1832, railroad building was all too new; that it was still in an early stage of development, and that nobody in America, or even in England, had a full and firm understanding of just what a railroad was supposed to be, or how it was to be built. All of this is true. But other engineers did a much better job of coping with the uncertainties and the technical and managerial problems which confronted them than did John Randel, Jr.

The Technology

Before discussing specific technical features found on the New Castle and Frenchtown Railroad, it is important to emphasize that the railroad's technology was derivative, that its directors and engineers were borrowers of technology. They did not want to solve problems through experimentation or invention; they wanted to apply solutions that already had been tested elsewhere.

They borrowed their technology in a number of ways and from a number of sources. One source was the Liverpool and Manchester Railway in England. No one directly connected with the New Castle and Frenchtown had ever been to England to examine railways there, but they took advantage of opportunities to question those who had made the journey. Any engineer who had actually seen the Liverpool and Manchester (or the Stockton and Darlington) and who had returned to the United States to work on railroads, was indeed a very important person. The V.I.P.s consulted by the directors of the New Castle and Frenchtown included William Strickland, Moncure Robinson and Jonathan Knight. Strickland visited the line and offered opinions on laying out curves and drains. [23] He judged the success of the railroad's graduation, its embankments and its general work. Moncure Robinson also toured the line and evaluated different track systems. [24] Knight consulted on the durability of different tracks and the types of locomotives they could support. [25]

The directors read reports of the English railways and kept abreast of who it was who was supplying them with equipment. They "borrowed"

some English technology by buying it outright, in the form of rails and locomotives. Besides borrowing from the English, they borrowed from their countrymen. If the Liverpool and Manchester was the pinnacle of English railroading, in this country the directors recognized the Baltimore & Ohio as the premier line. Immediately after their company was formed, they resolved that:

> . . .the Treasurer and Secretary be requested to go to Baltimore for the purpose of procuring information at the office of the Baltimore and Ohio Rail Road Company respecting the mode of keeping the accounts of the company and generally information respecting the construction, etc. of Rail Roads. [26]

Besides corresponding with Jonathan Knight, Chief Engineer of the B & O, the New Castle and Frenchtown men corresponded with James B. Stabler, Knight's Principal Assistant. They studied B & O tracks. They dealt quite extensively with P. E. Thomas, President of the B & O. Thomas, according to William D. Lewis:

> . . .gave us information on all points on which we asked it, and tendered us aid in every way that might be in his power. . . .[27]

Indeed, the B & O generously shared its knowledge, skills, and even it men. John Elgar, a B & O machinist, inspected the New Castle and Frenchtown's turnouts and switches; afterwards, he was hired to improve them. [28]

The directors were mindful of the progress of other early American railroads, besides the B & O. One or more of them are known to have personally examined the Germantown, Columbia, Little Schuylkill and Camden & Amboy railroads, and in all likelihood they visited several others as well. [29] These visits were often reciprocated. Information was shared when railroad entrepreneurs and engineers came to tour the New Castle and Frenchtown. It was with satisfaction and pleasure that a reassured William D. Lewis once wrote in his diary:

> . . .all the Engineers who had yet been on the road admire its lines and curves. [30]

The Route

John Randel commenced his survey of the railroad on 19 April 1830. [31] He did not locate the entire line at once. He had prepared at least 7 alternate plans for the eastern end of the line by 29 May 1830, and the directors adopted one of them on 16 July. They did not adopt a final line for the western end of the railroad until 16 October.

The 16 /12-mile-long right of way is shown on the HAER site location plan, which was derived from several extant early maps showing the railroad. [33] This line unavoidably passed over some undersirable terrain. Over swampy lowlands it required embankments and drains; areas of high ground demanded excavations. The route also passed over streams that had to be spanned and over roads that had to be guarded. Yet when compared with other early railroads, the route of the New Castle and Frenchtown was remarkably favorable, straight and flat. The adopted line ran only 853 yards longer than a straight line drawn between New Castle and Frenchtown. It incorporated only six curves, and these were long and sweeping. While some curves on the B & O had a radius of only 400 feet, the "tightest" curve on the New Castle and Frenchtown had a radius of over 10,000 feet. [34] The inclination of the line was also very favorable. After grading, much of the line was level, and with the exception of one stretch having a slope of 29 feet per mile, ascents and descents along the line measured only 10-1/2 feet to 16 feet per mile. [35]

The railroad company obtained a small portion of the land along its right-of-way by donation. More typically, it attempted to purchase needed land parcels by negotiation with individual owners. But in many instances, owners could not be located readily, or they demanded a price deemed too high by the company. To relieve these difficulties, both the Delaware and Maryland legislatures passed acts which allowed the railroad to take land by appraisement. Under the jurisdiction of the Court of Common Pleas of New Castle County, five disinterested freeholders examined land parcels and appraised their value. By paying the sum judged fair by the freeholders, the railroad acquired needed property. [36]

The width of the right-of-way allowed for a double track, even though the company at first laid only one. [37] The graded road bed measured some 26 feet wide, and the entire right-of-way extended to a width of at least 70 feet. [38] Because the company feared animals that might wander onto its tracks, it erected a wooden fence to enclose the right-of-way. [39] To make the passage between New Castle and Frenchtown more attractive to passengers, the railroad preserved those trees within the right-of-way that did not obstruct or endanger traffic. Also, a hedge and tree committee was formed to determine where the borders of the railroad could be enhanced by planting "Black or New Castle Thorn and also Ornamental Trees." [40]

The engineers divided the 16-1/2-mile length of the railroad into shorter, more manageable units. For surveying purposes, and to assist in identifying and locating specific sites, the engineers set numbered station markers at 100-foot intervals. Altogether, there were some 870 of these stations. For the purpose of managing the construction of the railroad, they cut the line into 17 sections which contractors bid on.

Grading

The railroad company employed about 9 different contractors to grade the 17 sections. [41] To prepare the line for track-laying, a contractor first cleared and grubbed timber and brush from the line. Then he had to embank or excavate earth in order to bring his section to the grade level established by the engineers.

The high ground that had to be excavated consisted primarily of clay, sand, or gravel. In the summer of 1830 the railroad experimentally excavated these materials by means of a horse-drawn grader that collected earth as it cut it. [42] Apparently this "self-loading cart" failed its test, for the railroad's contractors resorted to human pickers and shovelers. [43] The pickers loosened earth, while the shovelers loaded it into one- or two-horse carts which carried it off. This work, like that of embanking, was slow, hard, and paid poorly. Consequently, the progress of the New Castle and Frenchtown was often slowed by a lack of laborers. The railroad's directors and engineers constantly goaded contractors into hiring more men, and in desperation they beat the bushes to find themselves laborers and teamsters in cities like Philadelphia who could be coerced into moving to Delaware. [44] Eventually a labor force of some 1,100 men toiled along the line, and another 500 men could have been used.

Pickers and shovelers usually received from $ .80 to $ .87 1/2 per day; teamsters got $1.50 daily for a one-horse cart, and an additional 50 cents for a two-horse cart. Under good conditions, such as in the summer months, a laborer could excavate about 7 cubic yards of sand or gravel per day.[45] When the railroad pushed contractors to continue excavating in the winter of 1831-32, so that the road could open early in 1832, conditions were far less favorable. It was a cold winter, and frost was driven deep into the ground. Some frost was so deep that contractors had to resort to blasting with powder. In other instances, at the end of each work day laborers piled wood along the line and set it afire so that in the morning the ground would be thawed and workable. [46]

Altogether, some 500,000 cubic yards were excavated in grading the New Castle and Frenchtown. [47] The largest excavation was "Frenchtown Cut," just east of the railroad's terminus on the Elk River. Completing Frenchtown Cut was one of the most arduous tasks on the railroad. Much of the work was done in winter, and the ground was a tough, red clay. Frenchtown Cut ran for about a mile and reached a maximum depth of 37 feet. The excavation, stepped or terraced on the sides, was 26 feet wide at bottom and 170 feet wide at top. [48]

Frozen, tough earth presented the railroad with one problem; low, marshy ground presented quite a different one. Here the railroad had to run over earthen embankments which exhibited a strong tendency to sink. Director William D. Lewis noted this problem in

the spring of 1831. He and Samuel Nevins had walked the first 2 1/2 miles of the line out of New Castle, and in the course of their walk they crossed two marshes:

> The embankments across them are far advanced, but continue to settle, and the overseer informed us that in one of them it had already sunk 24 ft.; he thinks, however, from various indications that it is now finding bottom. [49]

To aid embankments in "finding bottom," Chief Engineer Randel had directed contractors to "cut" the surface of a marsh before they began embanking earth. [50] This procedure is not described in extant records, but it seems to have been derived from a practice used on the Liverpool and Manchester Railway by Engineer George Stephenson, who had cut Chat Moss before building across that bog:

> He had deep drains cut about five yards apart, and when the moss between those drains had become perfectly dry, it was used to form the embankment, where necessary; and so well did it succeed, that only about four times the quantity was required that would have been necessary on hard ground. Where the road was to be on a level, drains were cut on each side of the intended line, by which, intersected with occasional cross drains, the upper part of the moss became dry and tolerably firm; and on this hurdles [mats] were placed, either in double or single layers, as the case required, four feet broad and nine feet long, covered with heath. The ballast was then placed on these floating hurdles; longitudinal bearings, as well as cross sleepers, were used to support the rails where necessary; and the whole thoroughly drained. [51]

There is no evidence that Randel ever used hurdles or mats in crossing soft, spongy earth, but under his direction contractors did cut deep drains in marshes in order to make them more solid. Altogether, 420,000 cubic yards of earth (sometimes clay) were dumped into embankments varying in length from 1,200 to 3,000 feet, and in height from 15 to 25 feet. [52] Because they resisted "finding bottom," despite Randel's drains, these embankments were always deemed the weak links in the railroad, and they were recognized as safety hazards. William Lewis wrote that:

> . . .no travelling across them must be attempted after the road shall be completed, without its being the opinion of a majority of the Board, together with the Engineer, that that portion of it is perfectly safe. [53]

The low areas which necessitated embankments also often required culverts or bridges, so that streams or ground water could pass beneath the line without doing any damage. There were 4 "bridges" or "viaducts" and 29 culverts on the line. [54] Several of the stone

or stone and brick culverts still survive and are shown in the HAER drawings and photographs.

The culverts, like most all the structures on the railroad, were slow to be built. If the railroad had followed the natural order of things, Randel would have located and designed the culverts before contracts were ever let to grade the line, but he did not. By 2 September 1830, contracts had been let on 9 of the 17 sections, and it was not until that day that the directors instructed Randel:

> to report to this Board the number, dimensions and location of culverts required upon Sections No. 1. . .[through] 9 of the New Castle and Frenchtown Rail Road, with an estimate of the materials. [55]

On 10 September the directors had to repeat their instructions:

> the site and location, length, level, and inclination of the culverts on the line of Rail Road shall be prescribed and fixed by the Engineer in Chief who shall report the same in writing, to the Committee on Culverts on whom is devolved the duty to consult and determine with the aid of the engineer what shall be their respective construction and dimensions and to cause the same to be built. [56]

Randel and the directors finally arrived at a number of plans for culverts of different sizes, as the HAER graphics show. Some of the structures, such as Belltown Run Culvert, were built by section contractors while they were in the course of grading the line. [57] Others seemingly were built under special contracts initiated solely for the purpose of culvert construction. [58] One of the problems in finishing the culverts was a lack of stone needed as a building material. As late as 30 September 1831, 15 culverts on the middle third of the line had not even been started, and a lack of stone may have prompted the company to span some streams with wooden bridges. [59] The lack of quality stone may also explain why one finds such crude masonry in Belltown Run Culvert and in Perch Creek Culvert No. 2. It may also explain why the company sometimes resorted to using brick in culvert arches.

The Track

There was no consensus in 1830 when it came to the question of what kind of track a railroad should lay. Different companies chose different systems--and often a company installed more than one kind of track on its line:

> There are hardly two railways in the United States which are made in exactly the same way, and few of them are constructed throughout their whole extent on the same principles. [60]

The New Castle and Frenchtown Railroad was no exception to the rule of confusion over variant track systems. The company seriously considered three types of track in 1830-1831, and it eventually resorted to using two.

On 22 July 1830, the company directors were ready to invite proposals:

> for furnishing and laying Stone Rails, similar to those used in the construction of the Baltimore and Ohio Rail Road. [61]

These stone rails consisted of thin, strap iron rails mounted directly on granite sills. [62] The sills were placed longitudinally, with no crossties running between the two sides of the track. This type of rail initially appeared desirable for two reasons. First, it was economical. Strap iron rails were favored (over edge rails, for example) because they were lighter and therefore reduced the cost of importing British railroad iron. Secondly, the granite sills promised to provide a track with a strong and durable foundation.

The apparent advantages of stone rails dissipated over the summer of 1830, before the New Castle and Frenchtown ever began laying track. On other railroads, this type of track had exhibited two unfortunate tendencies. For one thing, the iron rails worked themselves loose; it was difficult to keep them securely fastened to the granite. Also, the sills provided a foundation that was too strong and firm. [63] They did not flex under traffic and therefore produced a hard and uncomfortable ride. Consequently, on 6 September 1830 the New Castle and Frenchtown directors selected a different mode of track construction:

> . . .it is expedient in the construction of the Rail Road to adopt Stone Blocks and Wooden String Pieces. [64]

This type of "permanent" track, with a gauge of 4 feet 8-1/2 inches, is shown in the HAER drawing. The stone blocks (granite) were bedded in sand and gravel to protect them from frost heave; cast iron knees and spikes secured the string pieces to the blocks; spikes also held the strap iron rails to the string pieces. The company obtained most of its granite blocks from Smith and Megredy in Port Deposit, Maryland and from Robinson, Carr & Co. in Quarryville, Pennsylvania; [65] the blocks cost upwards of $ .38 each. The knees were cast by Jonathan Bonney & Co. in Wilmington and by William Robinson & Co., place unknown, at a price of 6 to 7 cents a piece. [66] The railroad secured its spikes from Henry Burden and

the Troy Nail Works in New York. The 3-1/4-inch spikes cost 10 cents per pound, and the 4-1/2-inch spikes cost 9 cents. [67] The heart pine string pieces came from Savannah, Georgia by way of Charles Gwinn in Baltimore, and the strap iron rails were imported from Liverpool, England through the firm of A. & G. Ralston. [68]

The railroad contracted with Enoch Sweat, who had worked on the B & O, to lay its track. According to Sweat's original contract of 27 September 1830, he was to receive $3.90 per rod (16-1/2 feet) of track put down. [69] Sweat accepted this remuneration, assuming that the granite blocks supporting the track would be placed 4 feet apart, center to center. However, on 9 May 1831, just one week before Sweat was scheduled to begin work, the railroad's directors decided that the blocks should be only 3 feet apart. [70] This change meant more work for Sweat's men and dismayed the contractor. Sweat started to lay track on or about 16 May, but he did so begrudgingly. In order to appease Sweat, and to hasten his work, the railroad renegotiated his contract and increased his compensation. [71]

The new contract he received in June may have mollified Sweat somewhat, but it did little to speed him up. Throughout the summer of 1831, the railroad directors grew more and more disenchanted with Sweat and the slow pace that he set. His men had finished only 5 miles of track by September, and the company threatened to declare his contract vacated unless he managed to lay 1-1/2 miles of track a week. Respectful of Sweat in the beginning, William D. Lewis came to call the contractor a "braggart & probably a rogue." [72] In truth, although Sweat was cantankerous and perhaps employed too few laborers in his crew, [73] many of the delays in laying the track were no fault of his. Other contractors were slow in grading their sections, and Sweat at times was blocked by culverts that had not been built. He was also plagued by material shortages. In particular, granite blocks were in short supply, and at one time or another almost all of the other needed materials--the rails, spikes and string pieces--were scarce. [74]

By the time Sweat was just starting to lay track, the directors were already contemplating a partial switch-over to the "temporary" track shown in the HAER drawing, a track using wooden sleepers that rested on wooden sills. [75] In the fall of 1831, the railroad finally did switch-over to wooden sleepers, primarily because of the shortage of granite blocks. The company could not receive enough blocks to finish the line in time for an early opening in 1832. Also, the track founded on wooden sleepers was more economical, costing $2,250 less per mile than the granite-block railroad. [76] This economy was appealing, because the railroad company found itself short of funds and with higher costs than expected. In November 1830, the Chief Engineer had estimated the cost of the line at $204,000. On 2 May 1831, Randel had revised his figures upward; a single

rail would cost $250,000. By the time the line opened on 28 February 1832, the company had actually expended the much higher figure of $450,000. [77] So the switch to wooden sleepers was made out of necessity, but its economy was a welcome benefit. Approximately a third of the line was founded on wooden sleepers, and the "temporary" track was especially used on embankments, where the company believed that the track would soon have to be rebuilt because of soft, still-settling ground.

The company's single track began and ended at wharves in New Castle and Frenchtown, where there were docks for connecting steamboats, sidings, pivots, ticket booths, and train sheds. [78] In New Castle, the company erected a machine shop where its rolling stock could be serviced. Between New Castle and Frenchtown, there were some 7 turnouts and attendant switches. After a locomotive hit and killed a cow in April 1833, the road crossings along the line were guarded, and signal stations were erected which used flags to communicate a train's progress. [80]

Ironically, the portion of the railroad founded on wooden sleepers proved better than that founded on granite blocks. Instead of replacing the "temporary" track with blocks, the movement after the railroad opened was in the other direction; wooden sleepers were substituted for the blocks. [81] Besides providing a softer ride, the sleepers or cross-ties better maintained the railroad's gauge and kept the rails in place. Still, the railroad encountered serious problems with its track. The untreated sleepers and string pieces rotted out too readily, and of particular importance, the light, strap iron rails tended to come loose at the ends and curl up. Within 5 years after the line opened, it was:

> . . .in a very dilapidated state; scarcely a piece of the original string timber. . .is not in a state of decay; and most of the sleepers require removing from the same cause. [82]

Because of the poor condition of its first track, the railroad opened a second one in 1837, which used an edge rail fastened on wooden sleepers. [83] In the following year, the company began ripping up the first track and selling its rails for scrap.

Rolling Stock

From the very beginning, the directors of the New Castle and Frenchtown planned to use steam locomotives. When operations began on 28 February 1832, horses were used, and they completed the 16 1/2 mile trip in about 1 hour and 35 minutes. But horses were only a temporary expediency. The switch to locomotives was completed by fall, after numerous trials had proved them operable and safe.

When it came to selecting locomotives, the directors looked to England. A Colonel Long, an American, experimentally operated a locomotive of his design on a finished two mile stretch of the road in July 1831, but the directors never put Long's locomotive into commerical use. [84] Also, in June 1831, William Kemble of the West Point Foundry had offered to build an 8-horsepower, 3 1/4-ton locomotive for the railroad at a cost of $3,200. The West Point Foundry had already built two engines and was then at work on a third that would go to the Mohawk and Hudson Railroad. Kemble stated that "for plan and workmanship," the foundry's locomotives would "challenge the best of the English engines." [85] But the directors were not swayed. They had already decided, on 6 April 1831, that "it will be necessary to import from Great Britain two Locomotive Engines." [86] The directors wanted proven performance, so they turned to Robert Stephenson, who had built locomotives for the Liverpool and Manchester.

The railroad paid 850 pounds for its first Stephenson locomotive, and an additional 15 pounds 10 shillings for some spare parts. [87] Unfortunately, many of the technical features of this engine are unknown. According to Stephenson, it was a duplicate of "the lightest & most efficient of the Engines. . .working daily on the Liverpool & Manchester Railway." [88] Twelve feet long, the locomotive carried drivers 5 feet in diameter. The 11-inch piston had a stroke of 16 inches, and the cylindrical portion of the boiler was 6 feet 6 inches long and 2 feet 9 inches in diameter.

While procuring the locomotive, the New Castle and Frenchtown directors tried to import "a competent engineer to put it in operation and attend to it when employed." [89] Failing in this attempt, when the railroad received the first Stephenson locomotive on 1 April 1832, which had been partially disassembled for shipment, it turned to M. W. Baldwin of Philadelphia for assistance in assembling the engine and getting in running order. [90] This mechanical work was later performed by Edward A. Young, who had previous experience with steamboats and who may have worked before on locomotives. [91] In the summer of 1832, Young readied the two Stephenson locomotives then on hand for service, while Randel rather frantically worked to correct numerous weak points in the line that could prove disastrous when crossed by a heavy locomotive. By 10 September, the directors were convinced that both the track and the locomotives were ready for sustained use, so the company sold most of its horses and discharged its drivers. The two locomotives began regular runs, at the slow but safe pace of about 16 miles per hour, and to commemorate their use, a gala celebration was held in New Castle. [92]

The first stage-coach-like cars pulled by the locomotives were constructed for the most part by Richard Imlay in Baltimore; Imlay had built cars before for the B & O. When William Lewis first contacted the carriage-maker, he informed him that the railroad wanted

"good, substantial & at the same time sightly cars which shall contain each from 20 to 30 passengers." The cars were to be comfortable, with wide seats stuffed with hair and covered with cloth. They were to be low-slung and "of the most improved construction now in use in this country, with all the fixtures of the best kind. Yet Imlay was to understand that:

> . . .the Directors are desirous of having their cars good, but not to have wanted on them unnecessary expense by giving to their bodies any peculiar beauty of form or decorations. [93]

The cars Imlay built for the company, some with seating on top, and some perhaps with more "beauty of form" than others, cost $575 to $875 each.

Conclusion

The New Castle and Frenchtown Railroad fell on hard times in the 1840s and was defunct by the 1850s. The eastern third of the right-of-way was taken over by another railroad, and indeed that part of the right-of-way is still in use today. But the remainder of the line was abandoned, the tracks ripped up and sold. The railroad had been a portage--a short overland passage in what was otherwise an all-water-journey from Philadelphia to Baltimore. The portage railroad was doomed as soon as the Philadelphia, Wilmington and Baltimore Railroad established an all-overland route between the two major cities.

Some early American railroads, such as the B & O, are of historical significance because they were pace-setters. They showed the way for others and grew to become of great economic importance to a region or the nation. The New Castle and Frenchtown was not one of those railroads. Its significance stems from the fact that it was a follower, not a leader. Caught up in the first wave of railroad enthusiasm, the movers behind the New Castle and Frenchtown found themselves in a business which they did not know much about, so they had to turn to others for help and ideas. Consequently, the history of the first few years of the New Castle and Frenchtown documents the many technical problems which confronted the first-generation railroad builders. It also provides data on how early railroad technology was transferred from England to the United States, and then diffused throughout the country.

NOTES

[1] This report is primarily concerned with documenting the technology employed in constructing the railroad. For a business history of the railroad and the turnpike companies it evolved from, see William F. Holmes, "The New Castle and Frenchtown Turnpike and Railroad Company, 1809-1838," in Delaware History, X, 1 (April 1962), pp. 71-104; X, 2 (October 1962), pp. 152-180; X, 3 (April 1963), pp. 235-270.

[2] The initial directors were James R. Black, James Booth, Andrew Henderson, Frisby Henderson, Thomas Janvier, William McDonald, Andrew McIntyre, John Moody, George Read, James Rogers, Thomas Rogers, James Smith, and Thomas Stockton.

[3] See Holmes, X, 2, p. 171.
George Read and James Rogers were dropped as directors; James R. Black and Thomas Rogers had resigned. They were replaced by William D. Lewis, Samuel Nevins, Thomas Hale, and Benjamin Lewis.

[4] Holmes, X, 2, p. 175.

[5] Samuel Nevins to William D. Lewis, March 2, 1832. New Castle and Frenchtown Railroad Company Papers. Historical Society of Delaware. This collection is hereafter cited as "Railroad Papers."
Nevins full quote reflects the uncertainty of building the railroad. Written just after the opening, he advises Lewis that, "We have had a glorious triumph. . . ." Then he immediately adds words of doubt and caution,"for mercy sake do everything to make the track safe."

[6] New Castle and Frenchtown Turnpike and Railroad Company, Minutes of Directors' Meetings, April 15, 1830, Acc. 722, Eleutherian Mills Historical Library. Hereafter cited as "Minutes."

[7] To assure that their reviews were thorough and covered all important aspects of the railroad, the directors formed many small committees with special areas of interest. There were committees, for example, on culverts and drains.

[8] Minutes, April 1, 1830.

[9] The character reference from Clinton is found in [Mathew Carey,] Exhibit of the Shocking Oppression. . .Suffered. . .by John Randel, Jun. (Philadelphia, 1825), p. 7.

[10] Shocking Oppression, p. 5.

[11] All the men listed are known to have definitely served in the engineering department. Others, whose names appear without job titles in company records and who may have served as assistants,

included Norris Caulk, John Dennison, William Graham, William Vining, Joseph Lafferty, and Benjamin Janvier. See Minutes, April 3, April 17, 1830; March 14, April 16, May 6 and May 13, 1831. Also see Railroad Papers, "Disbursements up to 30th April 1831," box 88, folder 7; and "Disbursements on Account of New Castle & Frenchtown Railroad to 19 March 1832," box 89, folder 2.

[12] None of Randel's assistants are found on the "List of Civil Engineers to be Included in the Completed Biographical Dictionary of American Civil Engineers." This list is found (pp. 135-163) in A Biographical Dictionary of American Civil Engineers (New York: American Society of Civil Engineers, 1972).

[13] Holmes, X, 2, p. 173.

[14] Resolution regarding Engineer in Chief, n.d., Railroad Papers, box 88, folder 2.

[15] Untitled statement of Chief Engineer's responsibilities, n.d., Railroad Papers, box 88, folder 2.

[16] William D. Lewis Diary, insert, May 16, 1831. Historical Society of Delaware. Hereafter cited as "Lewis Diary."

[17] Minutes, March 21, 1832.

[18] Nevins to Lewis, October 19, 1831, Railroad Papers.

[19] Nevins to Lewis, March 24, 1832, Railroad Papers, box 89, folder 2.

[20] Minutes, December 24, 1830.

[21] See Lewis Diary, insert, Mary 16, 1831, and Minutes, April 15, 1831.

[22] Minutes, August 15, 1831.

[23] Lewis Diary, May 22 and September 24, 1831. "Shickland's Diagram," Railroad Papers, n.d., box 88, folder 2.

[24] Nevins to Major Thomas Stockton, October 16, 1831, Railroad Papers. Also Lewis Diary, October 17, 1831.

[25] Lewis Diary, November 14, 1831.

[26] Minutes, May 1, 1830.

[27] Lewis Diary, June 11, 1831.

[28] Notebook, entries March 28 and April 11, 1832, Railroad Papers, box 88, folder 7. Also J. Elgar to Lewis, June 2, 1832, Railroad Papers.

[29] Lewis Diary, November 14, 1831. Also Nevins to Lewis, September 20, 1831, Railroad Papers.

[30] Lewis Diary, October 5, 1831.

[31] No complete list of surveying equipment used by Randel and his assistants survives. Through 19 March 1832, the railroad company spent a total of $563.87 on "Engineers' instruments," but the only individual instrument known to have been purchased was an engineer's level with compass made by Stancliffe & Draper. This instrument cost $160.

[32] Minutes, April 24, May 29, July 16, October 16, 1830.

[33] Unfortunately, no detailed map of the railroad, showing the wharves, sidings, pivots, culverts, and car sheds was found. The most detailed maps would seem to be: W. L. Ritchie, "Map of the New Castle and Frenchtown Rail Road, 1838," found in the Hall of Records, Dover, Delaware. This map carries a profile of the line. Other maps are: Samuel Rea and Jacob Price, "Map of New Castle County Delaware, 1849," located at the Eleutherian Mills Library; Rea and Price, "A Map of the State of Delaware, 1850," also at Eleutherian Mills.

[34] American Rail-Road Journal, I, 6 (February 4, 1832), p. 81.

The radii of the curves varied from 10,560 to 20,000 feet. These broad curves not only allowed locomotives to track more easily, they also allowed for easier construction and maintenance. Tight curves tended to spring a track out of alignment, as noted by James P. Stabler, Principal Assistant Engineer of the B & O, in a letter to Lewis written on June 21, 1831:

> It has been found that the spring of the scantling or its tendency to become straight after having been curved, on the stone block railway operates to alter the vertical or lateral position of the track.

[35] H. S. Tanner, A Description of the Canals and Railroads of the United States (New York, 1840), p. 147.

The railroad apparently expected equal traffic in both directions. Consequently, there was no attempt to establish the railroad's elevation at levels that would favor either east-west of west-east travel.

[36] Holmes, X, 2, pp. 167-169.

[37] While laying the first track, the company continually toyed with the idea of laying a second to facilitate traffic in both directions. By the time a second track finally opened in 1837, it was not really an additional line, it was a replacement.

[38] As construction costs rose, the width of the graded road bed declined. From 35 feet wide, it fell to 32 and then to 26 feet. See Minutes, July 13 and 21, 1830; and American Rail-Road Journal, I, 6 (February 4, 1832), p. 81.

[39] The fence used white oak posts and cedar or chestnut rails. Despite the fence, the fear of accidents remained strong with the directors who wanted to maintain a safety-conscious image. When the first locomotive ran over a portion of the line in July 1831, Samuel Nevins wrote William D. Lewis: "I am getting used to the Locomotive and have no other fear than running foul of a cow or a Negro." (July 7, 1831, Railroad Papers, box 88, folder 3.)

[40] Minutes, October 29, 1830.

[41] The entire line was not put under contract at the same time. Moving west out of New Castle, sections 1 through 3 were contracted for on 20 July 1830; numbers 4 through 9 on or about 2 September of that year. The remaining sections were put under contract near the end of October 1830. The contractors were give three months to complete, and few, if any, met that deadline.

The company advertised for contractors' bids in two Philadelphia papers, two Wilmington papers, and in one Baltimore paper. No bids or contracts are known to have survived. In all likelihood, contractors did not bid a lump sum for grading any one section. Instead, they bid prices on different types of work, e.g., so many dollars for grubbing timber along a section, so many cents to be received for each cubic yard of clay, sand or gravel to be excavated, and so on. An important part of the engineering department's work, then, was to prepare estimates of the quantities of various types of work to be found in each section. These estimates were used to evaluate contractors' bids, to arrive at a total dollars figure for each bid. Once construction started, the assistant engineers had to monitor the contractors' work; they had to measure all the various types of work actually performed in order to determine how much a contractor would be paid.

[42] Minutes, July 10, 1830.

[43] Minutes, April 6, 1831. Other laborers were classed as "bankers" or "road menders."

[44] See Randel to Lewis, May 5 and 18, 1831, Railroad Papers, box 88, folder 3. Also, Holmes, X, 2, pp. 171-172.

[45] Lewis Diary, May 9, 1831.

[46] Holmes, X, 2, p. 179; Lewis Diary, December 19, 1831; Randel to Lewis, December 15 and 19, 1831, Railroad Papers.

[47] American Rail-Road Journal, I, 6 (February 4, 1832), p.81.

[48] Lewis Diary, April 8 and May 22, 1831.

[49] Lewis Diary, April 8, 1831.

[50] Minutes, December 20, 1830.

[51] Samuel Smiles, The Life of George Stephenson (Chicago, 1883). p. 221.

[52] American Rail-Road Journal, I, 6 (February 4, 1832), p. 81.

[53] Lewis Diary, June 4, 1831.

[54] Tanner, p. 147; American Rail-Road Journal, I, 6 (February 4, 1832), p. 81.

[55] Minutes, September 2, 1830.

[56] Minutes, September 10, 1830.

[57] Lewis Diary, September 30, 1831.

[58] See Minutes, February 28, 1831.

[59] Lewis Diary, September 30, 1831.
According to Thomas Simpers who owns land crossed by the railroad right-of-way in Maryland, a wooden bridge used to stand over Perch Creek on this property. Simpers himself never saw the bridge; he was informed of its existence by an elderly gentleman who previously owned the property.

[60] David Stevenson, Sketch of the Civil Engineering of North America (London, 1838), p. 240.

[61] Minutes, July 22, 1830.

[62] An illustration of "stone rails" used on the B & O is found in The Catalogue of the Centenary Exhibition of the Baltimore & Ohio Railroad, 1827-1927 (Baltimore, 1927), opposite p. 116. Description of early tracks used by the B & O can also be found in Edward Hungerford, The Story of the Baltimore and Ohio Railroad, 1827-1927 (New York, 1928), pp. 69-72, 116-118.

[63] See Lewis Diary, November 14, 1831.

[64] Minutes, September, 1830.

[65] According to contract specifications, these blocks were supposed to be at least 20 inches long, 12 inches wide, and 12 inches deep. The railroad rejected approximately 5% of them. Despite this inspection, the railroad used many blocks which were considerably smaller than what the contracts called for. An examination of extant blocks showed that some were as little as 16 inches long, 11 inches wide, and 7 1/2 inches deep. Because the railroad was constantly faced with a shortage of blocks, it must have felt it necessary to relax the restrictions in their size.

See "Copy of Robinson, Carr & Company agreement to furnish blocks," May 28, 1831; "Account of Stone locks delivered by Robinson, Carr & Company to the New Castle and Frenchtown Rail Road Company," n.d.; and "Rail Road Memoranda," notebook, October 24, 1831. All found in Railroad Papers, box 88.

[66] See minutes, January 24 and March 18, 1831.

The railroad used knees of two sizes. The smaller knees weighed 1 1/4 pounds each, and the larger 1 1/2 pounds. The larger knees may have been used on blocks where two string pieces were butted together.

[67] "Memorandum of Spikes and Plates received from Burden," n.d., Railroad Papers, box 88, folder 2. Also see Nevins to Lewis, July 6, 1831; Railroad Papers, box 88, folder 3; and "Railroad Memoranda," notebook, October 9, 1831, Railroad Papers, box 88, folder 5.

[68] The rails measured 5/8 by 2 1/4 inches in cross section, and came in lengths of approximately 16 feet. Each rail carried 12 countersunk holes and was mitred on the ends. At the juncture of two rails, a small wrought iron plate weighing 6.4 ounces was placed beneath the joint to hold the two rails together.

The company is known to have received at least 7660 rails from Ralston, at a cost of 7 pounds per ton. When a shipment from Ralston was delayed in the fall of 1831, the railroad purchased 828 bars of of railroad iron from the Little Schuylkill Company. This iron was only 2 inches wide and 1/2 inch thick. It is not known if any of this smaller iron was ever used on the line. See Minutes, November 23, 1830; "Ralston-Invoice Iron," July 14, 1831, J. Randel Deposition, n.d., and "Railroad Memoranda," notebook, October 2, 1831, Railroad Papers.

[69] Minutes, September 27, 1830.

According to this contract, Sweat was to transport the stone blocks from New Castle or Frenchtown, dig the holes for the blocks, drill the holes in the blocks needed to fasten the cast iron knees, supply the locust pins needed for fastening the knees, and supply one perch of sand or gravel for each rod of rail he laid. The railroad company agreed to deliver all needed spikes, rails, and string pieces to Sweat's workmen aiong the line.

[70] See Minutes, May 6 and 9, 1831. Also, "Memorandum -- for contract with E. Sweat & Company for laying track," n.d., Railroad Papers, Box 88, folder 2.

[71] Lewis Diary, June 11 and 17, 1831.

[72] Minutes, September 26, 1831; Lewis Diary, December 1, 1831.

[73] In early October, 1831, Sweat's force numbered "about 60 men, of whom 12 have come on within a few days." See "Railroad Memoranda," notebook, entry for October 11, 1831, Railroad Papers, box 88, folder 5.

[74] Holmes, X, 2, pp. 177 -178.

[75] The B & O was also experimenting with wooden sleepers, and William D. Lewis wrote to P. E. Thomas asking for information on the best means of laying such a track. See James P. Stabler to WIlliam D. Lewis, June 21, 1831, Railroad Papers, box 88, folder 3.

According to David Stevenson, Sketch of the Civil Engineering of North America (London, 1838), pp. 243-244, the wooden sills on the New Castle and Frenchtown Railroad were laid in two parallel tranches, over a bed of stone, well rammed in. Documentary evidence, however, suggests that the railroad laid its sills in one broad trench, rather than in two narrow ones.

The sleepers were notched to receive the string pieces, shown in the HAER drawing. It is not known for sure whether cast iron knees were used to aid in securing the string pieces to the sleepers. This practice was used on some railroads, and because the New Castle and Frenchtown had a large surplus of knees, it may have been used there too.

After the track was in place, it was gravelled. The railroad had one car for this purpose whose bottom could be opened to gravel the center of the track. It also had at least two whose side boards could be dropped to spread sand or gravel alongside the track.

[76] "Estimate of Cost of New Castle and Frenchtown Railroad," September 12, 1831, Railroad Papers, box 88, folder 9.

[77] See Holmes, X, 2, p. 169; and X, 3, p. 250. Also, Lewis Diary, November 23, 1835; and "Randel's Estimates," May 2, 1831, Railroad Papers, box 88, folder 3.

[78] Unfortunately, very little data survives regarding the structures found on the ends of the line. One sketch of Frenchtown Wharf (Lewis Diary, January 3, 1832) shows that the main track (the "passenger" track) carried two sidings, one called the "baggage car" track, and one labelled the "merchandise" track. The merchandise track further split into 5 sidings running to the wharf. Presumably, similar facilities were facilities were found in New Castle, along with a 100-foot long, 10-foot wide "carriage shed" which was entered by one of three tracks.

The pivots, or turntables, in New Castle and Frenchtown were installed by a Mr. Swanson, "according to the latest improved plan on the Liverpool and Manchester road." Swanson, it is believed, was sent down to work on the pivots by M. W. Baldwin of Philadelphia. (See Randel to Lewis, June 24, 1832, and Moody to Lewis, April 2, 1832, Railroad Papers.)

[79] The company at one time planned to construct 16 turnouts. That number dwindled to 7 or 8, and still the turnouts were not completed when the line opened. The switches, of unknown type, were installed by J. Elgar, who worked for the B & O. See "Railroad Memoranda," notebook entry for October 9, 1831, Railroad Papers; Lewis Diary, October 23, 1831, and January 23, 1832; notebook entries for March 28 and April 1, 1832, Railroad Papers, box 88, folder 7; and J. Elgar to Lewis, June 2, 1832, Railroad Papers.

[80] See Holmes, X, 3, p. 256, and "Balloon signal to be first hoisted. . .," n.d., Railroad Papers, box 88, folder 2.

[81] Minutes, March 21 and June 7, 1832. Also see Nevins to Lewis, March 24, 1832 and July 7, 1831, Railroad Papers.

[82] Minutes, June 13, 1837.

[83] See Minutes, April 10, August 14, October 10, 1935, March 25, April 14, July 14, 1836; March 9, May 1, June 13, June 22, 1837; April 5, June 14, 1838.

According to Tanner, p. 147, the new track used an H-rail. "The rail rests on flatted sleepers, three feet apart from centre to centre, reposing on three inch plank as an under sill: the last rests on the natural material forming the road bed. The rail is fastened down with spikes of the brad form, under the rails, at their joinings, is introduced a plain plate of wrought iron, equal in width to the bar of the rail and about five inches long. The ends of the rails are square, and the bars fifteen long."

[84] Nevins to Lewis, July 3, 4, and 6, 1831, Railroad Papers.

The tests of this locomotive were reported as successful; there are no reasons given as to why it was never put into service. This "Colonel Long" may well have been Stephen Harriman Long, who had worked with Jonathan Knight to route the B & O Railroad, and who later worked on locomotive designs.

[85] Kemble to Lewis, June 22, 1831, Railroad Papers. Also see Kemble to Lewis, June 6 and June 25, Railroad Papers.

[86] Minutes, April 6, 1831.

[87] W & I Brown & Company to Lewis, No. V 1, 1831, Railroad Papers. The spare parts were one pair of eccentrics and three packing boxes hooped with iron.

[88] Robert Stephenson to Captain Charles Dixey, June 2, 1831, Railroad Papers.

[89] Lewis Diary, April 20, 1831.

[90] Moody to Lewis, April 2, 1832, Railroad Papers.

[91] Holmes, X, 3, p. 247.
Young eventually became Principal Engineer and Superintendant of the railroad's blacksmith and machine shops. After working on at least three English locomotives, which he no doubt used as models, by as early as 1834 Young was building his own locomotives in New Castle.

[92] Holmes, X, 3, p. 248.
The locomotives had been tested at higher speeds, and would operate at higher speeds.

[93] Lewis to Imlay & Company, October 10, 1831, Railroad Papers.

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